# Physics 9th - English Medium

## CHAPTER 7: PROPERTIES OF MATTER

**Question 1: Explain the kinetic molecular model of the matter?**

Properties of kinetic molecular model of the matter:

1) Matter is made up of small particles which are known as the molecules.
2) Molecules are always in state of motion.
3) There is a force of attraction between the molecules.

**Note:** It expresses all the three types of the matter.

**Question 2: How Kinetic molecular model differentiates among three states of matter?**

Kinetic molecular model describes the motion of molecules and force of attraction between them due to which we can differentiate among three states of matter.

**Question 3: Write properties of the solid matter?**

**Properties of the solids:**

1) They have definite shapes.
2) They have a definite volume.
3) Due to the strong forces of attraction, the particles of solids are very close to each other.
4) The particles cannot move from one place to another. However, they vibrate about their mean position.

**Question 4: Write properties of the LIQUID matter?**

**Properties of the liquids:**

1) They don't have definite shape. So, they acquire the shape of the container in which it is poured.
2) They have specific volumes.
3) They have weaker inter molecular forces as compared to the solids. So, the molecules are not much close to each other as compared to the solids.
4) Their molecules can vibrate about mean position but remain strongly attached with one another.
5) The molecules slide over each other due to the weak forces.

**Question 5: Write properties of the gas?**

**Properties of the gases:**

1) They do not have definite shapes.
2) They do not have specific volume.
3) The molecules move freely with high random motion.
4) The spaces between the molecules are greater in the case of the gases.
5) They have weaker forces of attraction as compared to the solids and liquids.

**Question 6: What is plasma? Write its properties.**

**Plasma:** When a gas is heated the kinetic energy of its molecules increases. On further heating the amplitude of their vibrations increases and molecules collide with each other with great extent due to which atom of gas break down and positive and negative ions get separated. It is the ionic state of the matter. It consists of the positive ions.

**Properties of the plasma:**

**1)** It consists of the positive ions.
**2)** It is the most conductive state of the matter which can conduct electricity.

**Question 7: What is relationship between electric current and plasma?**

Plasma is the fourth state of matter which can be produced through electric current for example, when electric current is passed through a gas in a discharge tube it becomes plasma.

**Question 8: What is meant by the density? Write formula and its units?**

**Density:** Density is the mass per unit volume of a body.

**Formula:** D=m/v

**Units:** Kg / $m^3$

**EXAMPLE:** Water has density of 1000kg/$m^3$

**Question 9: A stone has volume of 200$cm^3$and a mass of the 500g. What is its density?**

Given: mass=m=500g

Volume=V=200$cm^3$

Required: Density=D=?

Solution:

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$$D = \frac{m}{v}$$

$$D = \frac{500}{200}$$

$$D = 2.5gcm^{-3}$$

**Question 10: Find the volume of the 0.2g gold rod whose density is 19300kg/m³?**

Given: mass=m=0.2kg

Density=D=19300kgm$^{-3}$

Required: Volume=V=?

Solution:

$$D = \frac{m}{v}$$

$$\Rightarrow V = \frac{m}{D}$$

$$V = \frac{0.2}{19300}$$

$$V = 1.036 \times 10^{-5} m^3$$

**Question 11: What is pressure and write its units?**

Pressure is the normal force acting per unit area of a body.

**Formula: P = F/A**

**Units:** Its SI units are N/m$^2$.Which is equal to Pascal.

1Pa =1N/1m$^2$

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**Question 12: Define atmosphere.**

The layer of gases around earth is called atmosphere.

**Question 13: What is the atmospheric pressure?**

**Atmospheric pressure:** It is the pressure which the atmosphere exerts per unit area of the sea surface. It acts in all directions. Its value is 101325 Pa. It is measured by using a mercury tube of the height 76cm. The pressure is calculated by measuring the change in the height of the mercury column.

**Question 14: Why air becomes less dense as we move upward?**

Due to decrease in atmospheric pressure air becomes less dense as we move upward.

**Question 15: Why atmospheric pressure changes with altitude.**

Maximum concentration of gases is found in lower few kilometers of atmosphere at high altitudes concentration of atmospheric gases decreases which means as we move upward concentration of atmospheric gases decreases due to which atmospheric pressure falls.

**Question 16: What is the barometer?**

The device used to measure the atmospheric pressure, is known as the barometer**.**

**Example:** Mercury barometer is a simple example

**Structure:** It consists of a one meter long glass tube filled with the mercury. It is inverted perpendicularly in the container of the mercury. The level of the mercury starts decreasing. It stops at a specific height. The atmospheric pressure at the sea level is measured by the height of this mercury tube.

**Question 17: Why water cannot be used in the measurement of the atmospheric pressure?**

Mercury is 13.6 times denser than the water. Atmospheric pressure can hold vertical of the water 13.6 times the height of the mercury.

$H = 13.6 \times 0.76 = 10.43m$

So, we need a column of about 11 m for the water. Therefore, we cannot use water

**Question 18: If there occurs a sudden increment in the reading of the barometer, what kinds of the atmospheric changes we can expect?**

It means atmospheric pressure is increasing and after that it will decrease which causes a dangerous change in the atmosphere.

**Question 19: Can we use hydrometer to calculate the density of the milk?**

Yes, we can calculate the density of the milk by using the hydrometer.

**Structure:** It consists of a long tube on which a scale is calibrated and it has a heavy part tied at the lower end. To measure the density, it is placed in the milk. Density is measured by the scale.

**Question 20: On what factors pressure of the liquid depend?**

Liquid pressure depends upon the height and the density of the liquid. Liquids exert pressure which act in all directions.

Following formula is used to measure the density at the depth h of the liquid.

$P = \rho gh$

**Note:** By increasing the depth, the pressure also increases.

**Question 21: What is the Pascal's law?**

Pressure applied at any point of liquid enclosed in a container, is transmitted without loss to all other parts of the liquid, This is called Pascal's law.

**Applications:** It is used in hydraulic brakes, hydraulic jacks, hydraulic press system and many other hydraulic machines.

**Note:** It is applicable for the liquids and the gases.

**Question 22: Write some applications of the Pascal's law? Or which law is used in the brake system of cars and buses?**

1) Hydraulic brakes.
2) Hydraulic jack.
3) Hydraulic press system.
4) Hydraulic machines.

**Question 23: What is Archimedes principle?**

When an object is totally or partially immersed in a liquid, an upthrust acts on it equal to the weight of liquid it displaces.

**Formula:**
$Upthrust\ force = \rho gV$

Where V is the volume of the displaced liquid and $\rho g$ is the weight of the displaced liquid.

1) Formula tells us that the upward force is equal to the weight of the displaced liquid.
2) This principle is applicable to both liquid and the gases

**Question 24: What is the principle of the floatation?**

A floating object displaces a fluid having weight equal to the weight of the object.

**Explanation:** An object sinks if its weight is greater than the upthrust acting on it. An object floats if its weight is equal to or less than the upthrust.

**Question 25: What is up-thrust force?**

When an object is totally or partially immersed in a liquid, a force acts on it in upward direction this force is called up-thrust force.

**Question 26: Why a lighter stone is drowned in the water and a bigger heavy ship does not?**

According to the principle of floatation, the stone is drowned because its weight is greater than the upthrust forces and the ship does not because it is designed such that its weight is lesser than the upthrust force. The upward forces are always equal to the weight of the water displaced by the body.

**Question 27: Explain how sub-marine moves on the surface of water and under water?**

According to the principle of floatation, an object floats when its weight is equal or less than up-thrust force If the weight of object is greater than up-thrust force the object sinks.

**Explanation:** Sub-marine floats over water when the weight of water equal to its volume is greater than its weight. It has a system of tanks which can be filled with and emptied of sea water. When these tanks are filled with seawater, the weight of submarine increases. As soon as the weight becomes greater than the up-thrust, it dives into water and remains under water. To come up on the surface, the tanks are emptied of sea water.

**Question 28: Give one difference and one similarity between ship and sub-marine.**

The similarity between ship and submarine is that both work on the principle of floatation and difference is that ship can travel over the surface of water but submarine can move under the surface of water as well.

**Question 29: How can the Archimedes principle is helpful in measuring the density of the body?**
According to the Archimedes principle,

The ratio between the weight of the body and the weight of equal volume water is the same as that of their densities.

**Formula:**

$$D = \frac{W_1}{W_1 - W_2} \times \rho$$

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**Question 30: Define deforming force.**

The applied force that changes shape, length or volume of a substance is called deforming force.

**Question 31: What is meant by the elasticity?**

The property of the material due to which it comes back to its original state after the removal of the deforming force, is known as the elasticity.

**Example:** As in spring balance, the spring comes back after the load has been removed.

**Question 32: What is the difference between the stress and the strain?**

| Stress | Strain |
| --- | --- |
| 1) It is the force per unit area of a body and it produces deformation.<br>**2) Formula:**<br>$\sigma = \frac{F}{A}$<br>**Unit:** Its unit is $N/m^2$ | 1) It is the ratio of change in length to the original length.<br>**2) Formula:**<br>$\epsilon = \frac{\Delta L}{L_o}$<br>**Unit:** It has no unit. |

**Question 33: Define tensile strain.**

It is the ratio of change in length to the original length. When change only occurs in length it is called tensile strain.

**Question 34: What is Hooke's law?**

Under the elastic limit, stress and strain are directly proportional to each other.

**Numerical form:**

$$F = -Kx$$

**Application:** It is used to find the change in the properties of the matter due to the stress under a specific limit.

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**Note:** Graph of Hooke's law tells us that how much stress should be applied so that permanent deformation does not occur.

**Question 35: What is meant by the elastic limit?**

It is that limit in which the body comes back to its original state after removing force.

**Question 36: What is meant by the young's modulus?**

According to the Hooke's law, the ratio of the stress to the strain is always constant. The ratio of the tensile stress of the tensile strain, is known as the Young's modulus.

**Numerical form:**

$$\gamma = \frac{F \times L_o}{A\Delta L}$$

**Unit:** Its unit is the $N/m^2$

## CHAPTER 8: THERMAL PROPERTIES OF THE MATTER

**Question 1: What is the difference between the heat and the temperature?**

| Heat | Temperature |
|---|---|
| 1) Heat is the energy that is transferred from one body to the other in thermal contact with each other as a result of difference of temperature between them.<br>2) Its unit is joule (J) | 1) Temperature of body is the degree of hotness or coldness of the body.<br>2) Its unit is Kelvin (K). |

**Question 2: What is meant by the thermal equilibrium?**

Heat transfers from hot object to the cool object when they come in thermal contact until the both bodies attain the equal temperature. This is known as the thermal equilibrium.

**Example:** A hot cup of tea is hot as compared to the room. The heat from the cup transfers to the room until both room and the cup of tea attain equal temperature.

**Question 3: How the temperature tells us about the direction of heat flow?**

Heat is the form of the energy which transfers from one body to the other due to the difference in the temperature .The heat transfers from the hot place to the cool place. It is called as the flowing energy. So, the heat transfers from the hot bodies to the cold bodies. This can help us in finding the direction of the heat flow, which is from hotter to cooler bodies.

**Example:** A hot cup of tea is hot as compared to the room. The heat from the cup transfers to the room until the both room and the cup of tea attain equal temperature. The heat transfers from hot cup to the cool environment.

**Question 4: Why does the heat flow from hot object to the cool object?**

The hot object has great level of energy as compared to the cool object. When the heat flows, the hot object gives its some energy and so its temperature becomes low. The cool object gets energy and so its temperature is increased. The cooler object has more ability to absorb energy. Therefore, the heat moves from the hot object to the cool object.

**Note:** This process of heat transfer continues until both the bodies attain the same level of the temperature.

**Question 5: Why heat is called Moving energy?**

Heat transfers from hot object to the cool object when they come in contact. Since heat can transfer from one place to another so it is called moving energy.

**Question 6: What is meant by the internal energy? On what factors it depends?**

The sum of the kinetic and the potential energies of the molecules of the matter is known as the internal energy.

**Dependence:**

1) Kinetic energy.
2) Potential energy.
3) Temperature.
4) Inter molecular forces. (force of attraction between the molecules)

**Note:**

1) Kinetic energy is due to the motion of the molecules.
2) Intermolecular forces are due to the forces of attraction between the molecules.

**Question 7: What is a thermometer? Why mercury is preferred in the thermometers?**

It is the device used to measure the temperature of the body.

Mercury is preferred in thermometers because:

**1)** It has linear thermal expansion.
**2)** It has low freezing point.(-39°C)
**3)** It has very high boiling point.(357°C)
**4)** It does not make the glass wet and is a good conductor of the heat.
**5)** It is visible

**Question 8: What are the functions of the clinical thermometer? And what is its range?**

The thermometer which is used to measure the temperature of human bodies is known as the clinical thermometer.

**Structure:** It has a construction that prevents the mercury to return. So, the reading cannot be changed until reset.

**Range:** It has a range of 35°C – 42°C.

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**Question 9: Write the properties of the thermometric liquid?**

The material whose volume changes with the temperature, is known as the thermometric material.

**Properties:**

**1)** It should have linear thermal expansion.
**2)** It should have low freezing point.
**3)** It should have very high boiling point.

4) It should not make the glass wet
5) It should be good conductor of the heat.
6) It should have less specific heat.
7) It should be visible

**Question 10: What is meant by the upper and the lower fixed points of the thermometer?**

On the thermometer, there is a scale on which there are two fixed points which are known as the upper and the lower fixed points.

| Upper point | Lower point |
|---|---|
| 1) It is the temperature where the water starts boiling.<br>2) Its value is 100°C on the Celsius scale, 212°F on Fahrenheit and 373K on the Kelvin. | 1) It is the point where ice starts melting.<br>2) Its value is 0°C on the Celsius scale, 32°F on Fahrenheit and 273K on the Kelvin. |

**Question 11: What are the temperature scales?**

There are three scales of the temperature:

1) **Celsius:** The distance between the upper and the lower fixed is divided into 100 equal parts. Upper fixed point is 100°C and the lower fixed point is 0°C.
2) **Fahrenheit:** The distance between the upper and the lower fixed is divided into 180 equal parts. Upper fixed point is 212°F and the lower fixed point is 32°F.
3) **Kelvin:** The distance between the upper and the lower fixed is divided into 100 equal parts. Upper fixed point is 373K and the lower fixed point is 273K.

**Question 12: What is absolute zero temperature?**

0K temperature is known as absolute zero temperature. Its value on Celsius is -273°C.

**Question 13: How the Celsius scale is converted into the Fahrenheit and the Kelvin?**

**Celsius into the Kelvin:**

$$k = \ ^{\circ}\mathrm{C} + 273$$

**Celsius into the Fahrenheit:**

**F= 1.8C +32**

**Question 14: Convert 100°F into the Celsius scale?**

**Given Data:**

**F= 100°F**

**Required: °C=?**

**Solution:**

**F= 1.8C +32**

**C = 100-32/1.8**

**C= 68/1.8**

**C= 37.7$^{o}$C**

**Question 15: Human body has a normal temperature of 98.6$^{o}$F. Convert it into the Celsius?**

**Given data:**

**F= 98.6 $^{o}$F**

**Required:**

**C=?**

**Solution:**

**F= 1.8C +32**

**C= F-32/1.8**

**C= 98.6-32/1.8**

**C=66.6/1.8**

**C=37$^{o}$C**

**Question 16: Convert 300 K into the Celsius?**

Given:

K=300K

Required:

C=?

Solution:

K=C+273

C= K-273

C= 300-273

C=27$^{o}$C

**Question 17: What is the temperature in Kelvin if we have a temperature of 20$^{o}$C?**

**Given:**

**C= 20°C**

**Required:**

**K=?**

**Solution:**

**K = C+273**

**K =20+273**

**K=293K**

**Question 18: Convert the 60°C into the Fahrenheit.**

**Given:**

**C=60°C**

**Required:**

**F=?**

**Solution:**

**F=1.8C+32**

**F= 1.8 x 60 +32**

**F= 108+32**

**F=140°F**

**Question 19: In a beaker, water has a temperature of 50°C. What is the temperature in the Fahrenheit scale?**

**Given:**

**C=50°C**

**Required:**

**F=?**

**Solution:**

**F= 1.8C+32**

**F= 1.8x50 +32**

**F= 90+32**

**F=122°F**

**Question 20: What is meant by the specific heat or the specific heat capacity?**

The amount of thermal energy required to increase the temperature of a body of mass 1kg through 1K, Is known as the specific heat.

**Formula:**

$$\nabla Q = mc\nabla T$$

$$c = \frac{\nabla Q}{m\nabla T}$$

**Unit:**

$Jkg^{-1}K^{-1}$

**Question 21: For a body of mass 0.5Kg, how much heat is required to increase the temperature from 10C to 65C?**

**Given:** **mass=m=0.5kg**

**Initial temperature=$T_1$=$10^0$c=10+273=283k**

**Final temperature=$T_2$=$65^0$c=65+273=338k**

**Required:** **heat=Ө=?**

**Solution:**

$$\Delta\theta = mc\Delta t$$

$$\Delta\theta = mc(T_2 - T_1)$$

$$\Delta\theta = 0.5 \times 4200(338 - 283)$$

$$\Delta\theta = 2100 \times 55$$

$$\Delta\theta = 115500J$$

**Question 22: What is the importance of high specific heat of the water?**

1) Water has a specific heat of $4200JKg^{-1}K^{-1}$.
2) It is used to release extra amount of thermal energy in the car cooling system.
3) Hot water is used to transfer heat from the boiler to the radiator through pipes in the central heating system.

**Question 23: Why water is added to cooling system of vehicle.**

The specific heat of water is large due to which water is used in cooling system of vehicles to remove extra amount of heat energy.

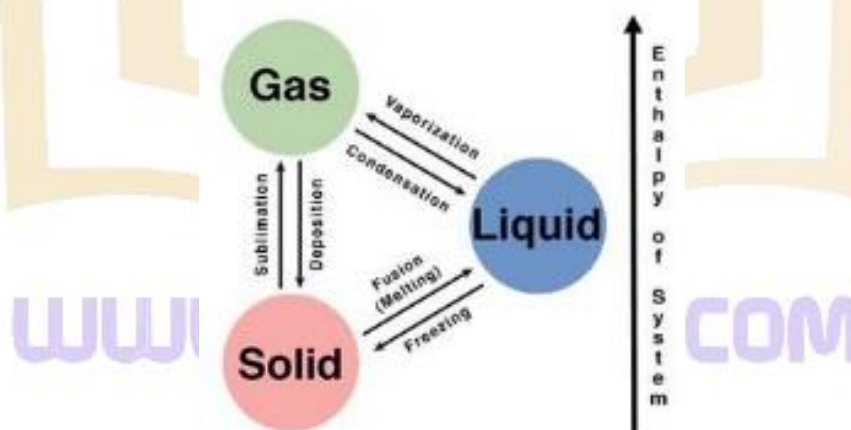
**Question 24: What is meant by the heat capacity?**

Heat capacity of a body is the amount of the thermal energy required to increase the temperature through 1K.

**Formula:**

Heat Capacity=mc

**Unit:**$JK^{-1}$

**Question 25: How the state of the matter changes with the thermal energy? Draw the diagram.**

**Question 26: What is meant by the latent heat of fusion?**

The amount of the thermal energy required to convert a unit mass of a solid state of a matter to the liquid state at its melting point without increase in its temperature.

**Formula:**

$$\nabla Q_f = mH_f$$

**Unit:** $JK^{-1}$

**Question 27: What is meant by the latent heat of vaporization?**

The amount of the thermal energy required to convert a unit mass of a liquid state of a liquid to the gaseous state at its boiling point without increase in its temperature.

**Formula:**

$$\nabla Q_v = mH_v$$

**Unit:** $JK^{-1}$

**Question 28: What are latent heats of fusion of the Aluminum and the copper?**

**Aluminum:** The latent heat of fusion of the aluminum is 39.7kJ/kg.

**Copper:** The latent heat of fusion of the copper is 205kJ/kg.

**Question 29: What are the two types of the latent heats?**

The amount of heat required to change a unit mass of matter from one state to another without changing its temperature, is known as the latent heat.

There are two types of latent heat:

1) Latent heat of fusion.
2) Latent heat of vaporization

**Question 30: What is difference between freezing and melting points?**

**Freezing point:** The temperature at which a substance changes its state from liquid to solid without change in its temperature is called freezing point.

**Melting point:** The temperature at which a substance changes its state from solid to liquid without change in its temperature is called melting point.

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**Question 31: What is the difference between the evaporation and the vaporization?**

| Evaporation | Vaporization |
|---|---|
| **1)** The conversion of liquid into the vapors without heating it is known as the evaporation.<br>**2)** In this process, only the molecules at the surface are evaporated.<br>**3)** This process happens at any temperature. | 1) The conversion of a liquid into the vapors at its boiling point is known as the vaporization.<br>2) In this process, molecules from the surface as well as from the inside of the liquid.<br>3) This can happen only at the boiling point of the liquid |

**Question 32: Why evaporation cause cooling?**

The molecules are in constant state of motion. The molecules with higher kinetic energy at the surface of the liquid leave the surface leaving behind the molecules with low kinetic energy. The average energy of the liquid decreases and as the temperature of the liquids depends upon the kinetic energy, the temperature of the liquid decreases with the evaporation. So, the evaporation cause cooling.

**Question 33: What are the factors affecting the evaporation?**

1) Temperature
2) Speed of the air
3) Area of the liquid surface
4) Nature of the liquid.

**Question 34: How the speed of the air affects the evaporation?**

The air flowing over the surface of the liquid takes the molecules at the surface with it and also prevents the molecules from coming back. The more molecules leave the surface when the speed of the air is high and the other molecules also find opportunity to leave the surface.

**Question 35: How the nature of the liquid affects the rate of evaporation?**

Difference in nature of the liquids causes different evaporation rates.

**Explanation:** For example, if the volatility of a liquid is greater, it will evaporate quickly. The volatility and the evaporation are directly proportional to each other.

**Example:** Water has less volatility than the petrol. Therefore, the petrol evaporates with a high rate.

**Question 36: Describe the effects of temperature on the evaporation?**

The temperature and the rate of the evaporation are directly proportional to each other.

So, at high temperature the molecules of the liquids move with large amplitude. They find more opportunity to leave the liquid surface. So, evaporation increases with the temperature.

**Question 37: What are the effects of surface area on the evaporation?**

Surface area and the evaporation are directly proportional to each other.

More the surface area, more the molecules will leave the surface and thus the rate of the evaporation increases.

**Question 38: Why the wet clothes are dried quickly in the summer as compared to the winter? Also define the process?**

As the temperature in the summer is high as compared to the winter, the process of molecules to leave the surface of the liquid becomes higher. Therefore, the wet clothes become dry quickly in summer as compared to the winter.

The process behind it is evaporation.

**Evaporation:** The process of changing liquid into the gaseous state without heating it is known as the evaporation.

**Question 39: What are two effects of vaporization of liquids?**

1) Due to vaporization temperature of liquid decreases.
2) Vaporization of liquid causes cooling.

**Question 40: Do water and the spirit evaporate with same rate? Explain.**

No, because their nature is different, they do not evaporate with the same rate.

**Explanation:** The volatility and the evaporation are directly proportional to each other. Water has less volatility than the petrol. Therefore, the petrol evaporates with a high rate.

**Question 41: What is meant by the thermal expansion? What is its application?**

When temperature increases, the length, breadth and the width of the body increase, this process is known as the thermal expansion.

**Explanation:** Kinetic energy depends upon the temperature. When the temperature increases, the kinetic energy of the body increase due to which the molecules vibrate with high amplitude. Their collision with each other becomes high. So, their expansion occurs.

There are two types of the thermal expansion.

1) Linear thermal expansion.
2) Volumetric thermal expansion

**Question 42: What are applications of thermal expansion?**

1) To open the tight lid of the bottle.
2) In thermometer, the thermal expansion is used to measure the temperature.
3) To make a joint between the steel plates.
4) To wear a circular sheet on the wooden wheels.
5) Bimetal thermostat.

**Question 43: What is the rate of the thermal expansion and write its numerical form?**

The change in the length or volume of the body due to an increase of 1K or 1°C in temperature, is known as the rate of thermal expansion.

**Linear thermal expansion:**

$$\alpha = \frac{\nabla L}{L_{\circ} \nabla T}$$

**Volumetric thermal expansion:**

$$\beta = \frac{\nabla V}{V_{\circ} \nabla T}$$

**Unit: $K^{-1}$**

**Note:** The rate tells us that how the shape changes with the increase in temperature.

**Question 44: What is the co -efficient of the linear thermal expansion?**

If a rod of one meter length is heated with a 1K difference of temperance, the change in the length is known as the co- efficient of linear thermal expansion.

**Formula:**

$$\alpha = \frac{\nabla L}{L_{\circ} \nabla T}$$

**Unit: $K^{-1}$**

**Question 45: Write the co- efficient of linear thermal expansion of gold and the silver?**
**Gold (co- efficient of linear thermal expansion):1.3 x $10^{-5}$ $K^{-1}$**

**Silver (co- efficient of linear thermal expansion): 1.93 x $10^{-5}$ $K^{-1}$**

**Question 46: What is meant by the volumetric expansion? Write equations.**

The change in the volume of a body due to the change in temperature is known as the volumetric expansion.

**Equation:**

$$\beta = \frac{\nabla V}{V_\circ \nabla T}$$

**Question 47: Define the co efficient of volumetric expansion? Write its SI units?**

The change in the volume of a body of unit volume due to a change of 1K temperature is known as the co efficient of volumetric thermal expansion.

**Formula:**

$$\beta = \frac{\nabla V}{V_\circ \nabla T}$$

**Unit: $K^{-1}$**

**Relation with the co efficient of linear expansion:**

$$\boldsymbol{\beta = 3\alpha}$$

**Question 48: What is effect of Heat on motion of molecules of gas?**

Molecules of gas are always in state of random motion. When the temperature of a gas is increased the average kinetic energy of its molecule increases due to which the amplitude of their vibrations increases and they collide with each other with large amplitude and push each other due to which a gas expands.

**Question 49: What is meant by irregular expansion of water?**

When water is cooled down from 100$^{o}$C to 4$^{o}$C it contracts like other substances but on cooling below than 4$^{o}$C upto 0$^{o}$C it expands. This unusual expansion of water is called irregular expansion of water.

**Question 50: Why gaps are kept between railway tracks.**

We know that substances expand on heating and contract on cooling. Railway tracks buckled on a hot summer day due to expansion if gaps are not left between sections.

**Question 51: Give uses of bimetal strips.**

A bimetal strip consists of two thin strips of different metals such as brass and iron joined together

**Uses of Bimetal strip:**

1) Bimetal strips are used to measure temperatures especially in furnaces and ovens.

2) Bimetal thermostat switch is used to control the temperature of heater coil in an electric iron.

**Question 52: Why liquids expand on heating?**

On heating a liquid, the average amplitude of vibrations of its molecules increases. The molecules push each other and need more space to occupy. This accounts for expansion of the liquid when heated.

**Question 53: Give types of liquid expansion.**

There are two types of liquid expansion: (1) Real expansion (2) Apparent expansion**.**

**Question 54: What is meant by real and apparent expansion?**

**Real Expansion:** The Expansion of the volume of a liquid taking into consideration the expansion of the container also, is called the real volume expansion of the liquid.

**Apparent Expansion:** The Expansion of a liquid without consideration of the expansion of the container is called the apparent volume expansion of the liquid.

**Explanation:** Take a long necked flask. Fill it with some colored liquid upto the mark A on its neck. Now start heating the flask from bottom. The liquid level first falls to B then rises to C. The heat first reaches the flask which expands and its volume increases. As a result liquid descends in the flask and its level falls to B. After sometime, the liquid begins to rise above B on getting hot. At certain temperature it reaches at C. The rise in level from A to C is due to apparent expansion in the volume of liquid while the increase in volume from B to C is called real volume expansion of liquid.

**Real expansion = Expansion of vessel + Apparent Expansion**

# Chapter 9: TRANSFER OF HEAT

**Question 1: What is the transfer of heat and tell about the ways of the heat transfer?**

Transfer of thermal energy from hot body to the cool body in the form of the heat is known as the heat transfer.

It is a natural process in which heat is always transferred from hot body to the cool boy.

**Ways of heat transfer:**

1) Conduction
2) Convention
3) Radiation

**Question 2: Why the cup of hot tea gets cool after sometime?**

Heat is transferred from hot to cool bodies. It depends upon the level of temperature and state of the surface. As in start, the cup of tea is hotter than the room. So, the heat is transferred from hot tea cup to the room. This process continues until the both the room and the cup get the same equilibrium temperature.

**Question 3: Why the ice cooled water glass gets warm after sometime?**

Heat is transferred from hot to cool bodies. It depends upon the level of temperature and state of the surface. As in start, the glass of water is cooler than the room. So, the heat is transferred from hot room to the glass. This process continues until the both the room and the glass get the same equilibrium temperature.

**Question 4: Explain the difference between the conduction and the convention?**

| CONVENTION | CONDUCTION |
|---|---|
| 1) The process of heat transfer which is due to the actual movement of the molecules is known as the convention.<br>2) It causes heat transfer in fluids.<br>3) In this process the molecules leaves their places and their movements causes the heat transfer.<br>**4) Example:**<br>When the water is boiled, the water at the lower surface being warm comes at the upper surface and the water which is cool takes its place, this process is | 1) The vibratory motion of the solids or the motion of the free electrons causes the heat transfer.<br>2) It causes the heat transfer in the solids.<br>**3) Example:**<br>When the rod is heated at one end, the whole rod is warmed after sometimes. |

| known as the convention. | |
|---|---|

**Question 5: why the process of the conduction does not occur in the gases?**

Conduction is the process in which heat is transferred by the vibratory motion of the solids molecules. But the molecules of the gas are always in the random motion, the heat in the gases is transferred due to the actual movement of the molecules. Therefore the conduction does not take place in the gases.

**Question 6: What is meant by the thermal conductivity?**

The rate of the heat transfer between the two opposite surfaces of 1m³ at the temperature difference of the 1K, is known as the thermal.

**Formula:**

$$q = \frac{k\,A\,\Delta T}{L}$$

**Unit: $Wm^{-1}\,K^{-1}$**

**Dependence:**

It depends upon the nature of the materials and it is different for every material.

**Question 7: What is the effect of the length on the thermal conductivity of the solids?**

**Relation between the length and the thermal conductivity:**

According to the formula of the thermal conductivity of the solids,

$$q = \frac{k\,A\,\Delta T}{L}$$

The length and the thermal conductivity are inversely proportional to each other. So, thermal conductivity decreases as we increase the length. The heat transfer and the thermal conductivity are directly proportional to each other. So, the heat transfer also decreases with the increases in the length.

**Question 8: What is meant by the rate of heat transfer? On what factors does it depend?**

The amount of heat which is transferred per unit time is known as the heat transfer rate.

**It depends on the:**

1) Length of the solids
2) Cross sectional area
3) Temperature difference.

**Formula:**

**Rate of Heat Transfer = Q/t**

**Unit: J $s^{-1}$**

**Question 9: What steps can be taken to save energy at homes?**

1) The hot water tank should be insulated by the insulators.
2) The ceiling should be made by some insulators.
3) Wall cavities should be filled with plastic foam.
4) Double sheet glass gazed should be used for the windows. The air between the sheets can flow and works as an insulator.

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**Question 10: What is difference between conductors and non-conductors?**

| CONDUCTORS | INSULATORS |
|---|---|
| Substances from which heat can pass are called conductors.<br>**Examples**: metals like iron, cooper etc. | Substances from which heat cannot pass are called insulators.<br>**Examples**: non-metals like wood, plastics etc. |

**Question 11: Give uses of conductors**

1) Conductors (metals) are used for quick heat transfer.
2) Metal boxes are used for making ice and ice cream.

**Question 12: What is the function of the stereo foam?**

This foam is a very bad conductor of the heat. It prevents heat from going out of the box. It is used for saving food for a long time in the box.

**Question 13: Why the double sheet glass bottle is used in the thermos flask?**

Thermos flask is used to maintain the temperature in its flask.

Double sheet glass layer is used in its bottle. It prevents the heat from going out or coming in from the flask. In this way, the thing is saved for a long time. Thermos prevents heat transfer which occurs due to the conduction, convention and the radiation.

**Question 14: Why the metals are the good conductor of heat?**

Metals have free electrons which are always in the vibratory motion. So the heat can be transferred fast and more efficiently.

**Question 15: Why the frying pans are made with the metals?**

Metals have free electrons which are always in the vibratory motion. So the heat can be transferred fast and more efficiently. Therefore, the pans are made of the metals.

**Question 16: What are the functions of the non-conductors?**

**Functions of non-conductors:**

1) For making handles of different frying pots.
2) These are used for the making ceiling.
3) They are used to prevent transfer of heat.
4) For insulating the hot water tanks.

**Question 17: Why the metals are felt cooler than the wood when placed on the cool place?**

Metals have free electrons which are always in the vibratory motion. So the heat can be transferred fast and more efficiently. But the non-metals do not have free electrons and so, the heat transfer in them is very less. As the wood is a non-conductor, the heat transfer in it is very low and therefore the metals are felt cooler than the wood.

**Question 18: Why in deserts, there is an instant heating during sun and an instant cooling after the sun set?**

The specific heat of the earth is 800 J/kegs. So, the earth has a great ability to absorb and transfer heat in a very fast way. This is the reason that the earth in the deserts gets warm quickly during sun and gets cool quickly after the sun set.

**Question 19: What is meant by the convection currents?**

The current produced due to the changing density of air is known as the convection currents.

**Explanation:** Due to the temperature difference, the density of the air changes continuously which produces convection currents which moves upward. These upward moving currents of hot air are known as the thermals.

**Question 20: what are the functions of the convection currents?**

1) During gliding, gliders ride on the thermals of the hot air which helps them to stay in the air for a long time.
2) The birds fly from one thermal to another and they can fly for a long time without moving their wings.

**Question 21: what is the reason of the long stay of the gliders in the air and what is meant by the gliding?**

The process of staying in air of the gliders is known as the gliding.

**Reason:** During gliding, gliders ride on the thermals of the hot air which helps them to stay in the air for a long time.

**Question 22: Write names of expert thermal-riding birds.**

Pigeon and eagle are expert thermal-riding birds.

**Question 23: What is difference between land breeze and sea breeze?**

| Land Breeze | Sea Breeze |
|---|---|
| The movement of cold air from the land toward sea is called land breeze.<br>**Explanation:** The specific heat of land is much smaller as compared to the water. At night the land cools faster than the sea. Therefore, air above the sea is warmer, rises up and the cold air from the land begins to move toward sea, is called land breeze. | The movement of cold air from sea toward land is called sea breeze.<br>**Explanation**: On a hot day, the temperature of the land increases more quickly than the sea. It is because the specific heat of land is much smaller as compared to water. The air above land gets hot and rises up. Cold air from the sea begins to move toward the land, which is called sea breeze. |

**Question 24: Why the heat exchange in the fluids occurs due to the convention?**

The molecules in the fluids remain in random motion and they leave their place. So, their heat exchange is due to their actual motion of molecules which is known as the convention.

**Question 25: What is meant by the radiation and on what factors does it depend?**

The process of heat exchange in which energy is transferred by help of waves, these waves are known as the electromagnetic waves.

**Examples:** The light from the sun is in the form of the radiation.

**Factors:**

1) Surface area
2) Surface color
3) Surface temperature
4) Surface nature

**Question 26: what is the relation between radiation and the surface area?**

The rate of radiation and surface area are directly proportional to each other. So, the more the surface area, the more will be the rate of radiation.

**Note:** In the radiator, to increase the surface area, a lot of wrinkles are made.

Radiation means transfer of energy from the surface in the form of electromagnetic waves.

**Question 27: How does energy from the sun comes towards us?**

The light energy from the sun comes in the form of the electromagnetic waves (radiation).

**Radiation:** The process of heat exchange in which energy is transferred by help of waves, these waves are known as the electromagnetic waves.

**Question 28: Describe four surfaces of Leslie cube.**

A Leslie cube is a metal box having faces of different nature. The four faces of Leslie's cube may be as follow:

1) A shining silvered surface
2) A dull black surface
3) A white surface
4) A colored Surface

**Explanation:**

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| Surfaces | Emitter | Absorber | Reflector |
|---|---|---|---|
| Dull black surface | Best | best | Worst |
| Colored surface | Good | Good | Bad |
| White surface | Bad | Bad | Good |
| Shining silvered surface | worst | Worst | Best |

**Question 29: What is greenhouse effect?**

In the atmosphere, there are vapors and carbon dioxide which act as polythene and trap the heat energy coming the sun. So, the temperature increases. This is known as greenhouse effect.

**Explanation:** This effect has become useful in plants. The green rooms are made in which the heat enters but the walls of the room are made such that the heat is trapped in them and the temperature of the room is increased.

**Question 30: what are the effects of greenhouse effect in global warming?**
In the atmosphere, there are vapors and carbon dioxide which act as polythene and trap the heat energy coming from the sun. So, the temperature increases. This is known as greenhouse effect.

**Effects:**

1) They have left dangerous effects on the environment of the earth.
2) Increased temperature causes the glaciers to melt quickly and so the water level in the oceans and the rivers have increased which cause floods.

**Question 31: write two effects of radiation?**

**Effects:**

1) In the summers, the light color clothes are used because they absorb less energy as compared to the bold colored clothes.
2) The polished surfaces reflect heat so internal surfaces of pots are polished.

**Question 32: Why we abstain from wearing dark colored clothes in the summer?**

The dark clothes absorb heat more as compared to the light colored clothes. Therefore, we abstain from dark colored clothes.

**Note:** In the summer, we usually use light colored or white clothes.

**Question 33: Why the lower outer surfaces of the cooking utensils are made black?**

The black or bold colored surfaces absorb more heat. Therefore, the lower surfaces of the cooking utensils are made black.